



# **INTEGRATED SURVIVABILITY ASSESSMENT: MEASURING THE BALANCE**

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## **BRIEFING SYNOPSIS:**

### **INTEGRATED SURVIVABILITY ASSESSMENT: MEASURING THE BALANCE**

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Measuring the balance between vulnerability and susceptibility technologies is a critical element in designing aircraft for survivability. But in order to measure that balance, a complete set of credible analytical tools needs to be available and accepted within the Joint Service community.

A workshop was held in May of this year, in Albuquerque, NM, whose objectives were: developing a common definition of Integrated Survivability Assessment (ISA), identifying customer requirements for survivability assessment, determining the need for ISA capabilities, understanding the contribution to those requirements from ongoing initiatives (such as JMASS and HLA), identifying shortfalls, and developing the start of a roadmap for the JTCG/AS to fill those shortfalls. This briefing will discuss the results of the workshop and their application to Joint survivability methodology development "into the next century."

A fairly significant number of "customers" at the workshop indicated that they require the ability to assess the military worth of weapons systems, and that survivability, as one part of an integrated assessment, needs to be addressed in a mission context. The ISA Workshop developed a list of requirements for the JTCG/AS to pursue, including the credibility of engagement level simulations (including Pk), mission level survivability modeling, and the inclusion of mission effectiveness and cost assessment in the analysis process. The output of the workshop provided guidance for defining the elements to include in a roadmap for future JTCG/AS activities, as well as actions to take with regard to JMASS developments and HLA.

**slides**

# OVERVIEW

- **CREDIBLE INTEGRATED SURVIVABILITY ASSESSMENTS ARE KEY TO THE ACQUISITION OF SURVIVABLE WEAPONS SYSTEMS**
  - We can't evaluate design tradeoffs without them
- **THOSE ASSESSMENTS ARE SELDOM DONE IN A MANNER THAT ADEQUATELY TRADES ALL SURVIVABILITY DESIGN OPTIONS**
  - EW, LO, Vulnerability, etc.
  - Results in less effective, more costly systems
  - In other words, we can't really agree on how to do systems engineering analysis for survivability
    - » What is the proper balance between vulnerability and susceptibility reduction features?
- **THE JOINT COMMUNITY (JTCG/AS) IS ADDRESSING THE PROBLEM:**
  - Integrated Survivability Assessment Workshop
  - Methodology Roadmap
- **AND WE NEED YOUR HELP**

# **WHY IS INTEGRATED SURVIVABILITY ASSESSMENT CRITICAL?**

- **SURVIVABILITY IS A KEY DESIGN DISCIPLINE AND COST DRIVER FOR AIR WEAPONS SYSTEMS**
- **MORE AND MORE EMPHASIS PLACED ON M&S IN THE AIR WEAPONS SYSTEM DESIGN PROCESS**
  - » Needed for requirements definition, specification development, system design, T&E & training
- **INTEGRATED SURVIVABILITY ASSESSMENT:**
  - » Reduces risk and cost in acquisition
  - » Ensures survivability performance
  - » Supports definition of realistic, supportable and cost-effective requirements

**PINPOINTS MOST COST-EFFECTIVE SURVIVABILITY TECHNOLOGIES  
FOR SYSTEM DESIGN**

# SURVIVABILITY SPECTRUM

INCREASING THREAT PROXIMITY- GREATER LEVEL OF THREAT INTERACTION

Vulnerability Reduction

Mission  
Planning  
Intell  
C4ISR

SEAD Assets  
(HARM,  
Decoys,  
SOJ)

Sig.  
Control  
(Stealth,  
EMCON)

Detect  
&  
Avoid  
(RWR)

On-board ECM

Expendables

Towed  
Devices

MAWS

Tactics - timing, operational concepts, energy, maneuver..

Susceptibility Reduction

# INTEGRATED SURVIVABILITY ASSESSMENT (ISA)

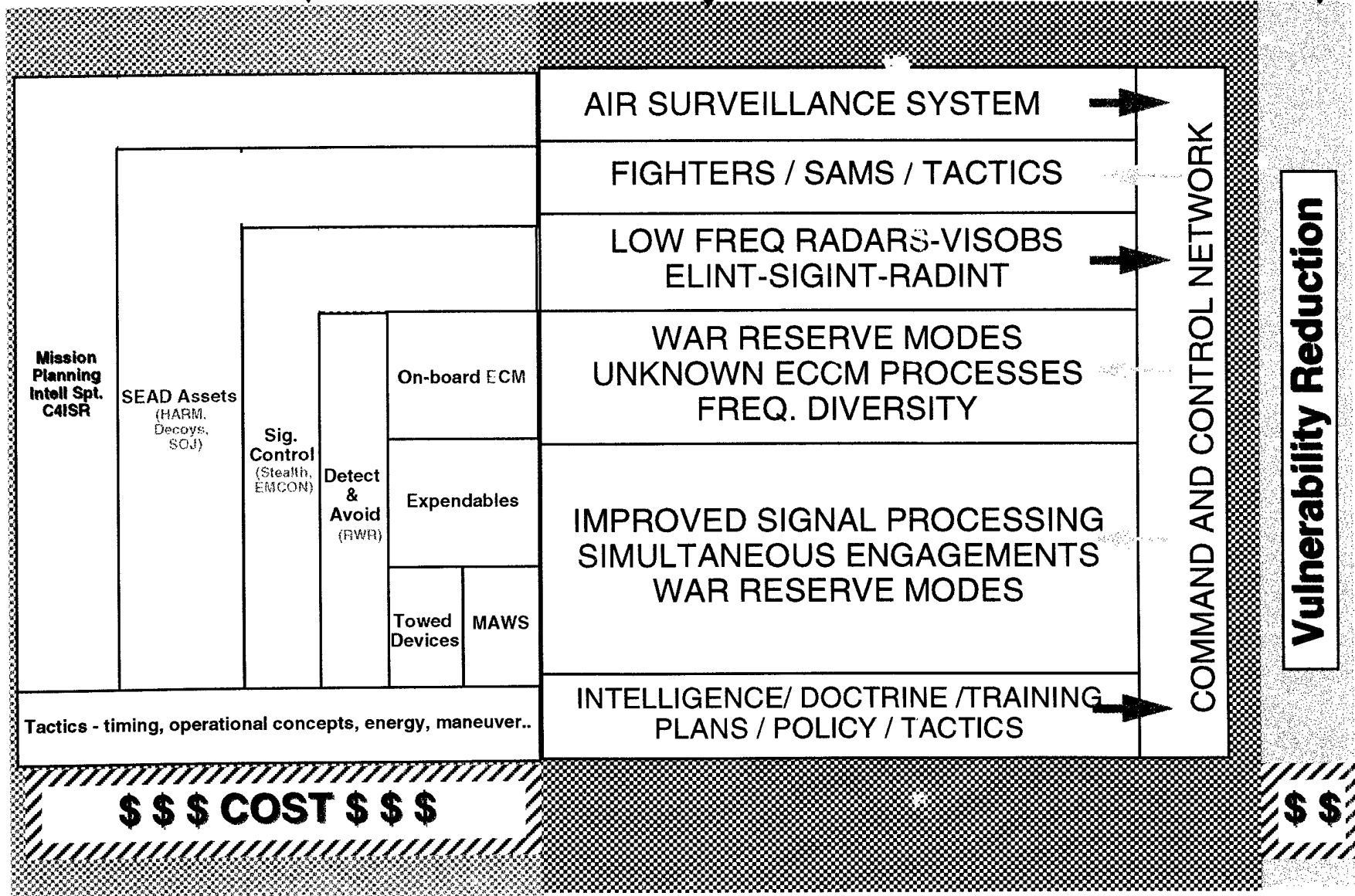
PLAY ALL THIS



AGAINST ALL THIS



AND SEE WHO SURVIVES



## **JTCG/AS GOAL: INTEGRATED SURVIVABILITY ASSESSMENT**

- **A standard methodology for design, development, T&E to include all aspects of survivability**
- **Facilitating evaluation of an air vehicle's ability to survive in an integrated air defense system environment**
  - **Can the aircraft survive to perform its mission?**
  - **Considering all onboard and "offboard" assets**
    - » **Including all support assets: Fighter support, SEAD (SOJ & HARM, TALD), etc.**
  - **Considering all threat assets**
    - » **IADS, GCI, Fighters, SAMs, GUNs, ...**
- **Distributed through the Survivability/Vulnerability Information Analysis Center (SURVIAC)**



# JTCG/AS ISA WORKSHOP

- **May 1997 in Albuquerque**
  - Sponsored by JTCG/AS and AFOTEC
- **Identified acquisition “Customer” needs for Integrated Survivability Assessment**
  - Good participation from OT, DT communities
    - » OSD, Services, Industry
- **Identified strengths and shortfalls in current M&S initiatives to satisfy those needs**
  - JMASS, HLA, DIME, etc.
- **Developed a roadmap to fill those shortfalls**
  - For the JTCG/AS

# **ISA WORKSHOP ORGANIZATION**

- **ISA DEFINITION**
- **REQUIREMENTS**
- **CURRENT INITIATIVES**
- **SHORTFALLS**
- **ROADMAP**

# **INTEGRATED SURVIVABILITY ASSESSMENT: A DEFINITION**

**A consistent process that combines, into an integrated whole, all the component parts of the survivability equation to support:**

- Survivability design based on mission effectiveness and cost goals**
- Accounting for the impact of increasing survivability on mission effectiveness**
- Real world operational requirements used in survivability risk assessment and trade off studies**

# **INTEGRATED SURVIVABILITY ASSESSMENT**

- **Integrated Systems**

- Conceptual view of “us” as a coherent organized system versus “them” as a coherent and organized system

- **Integrated Models**

- M&S Technology serving the assessment process by facilitating the comparison of Integrated Systems

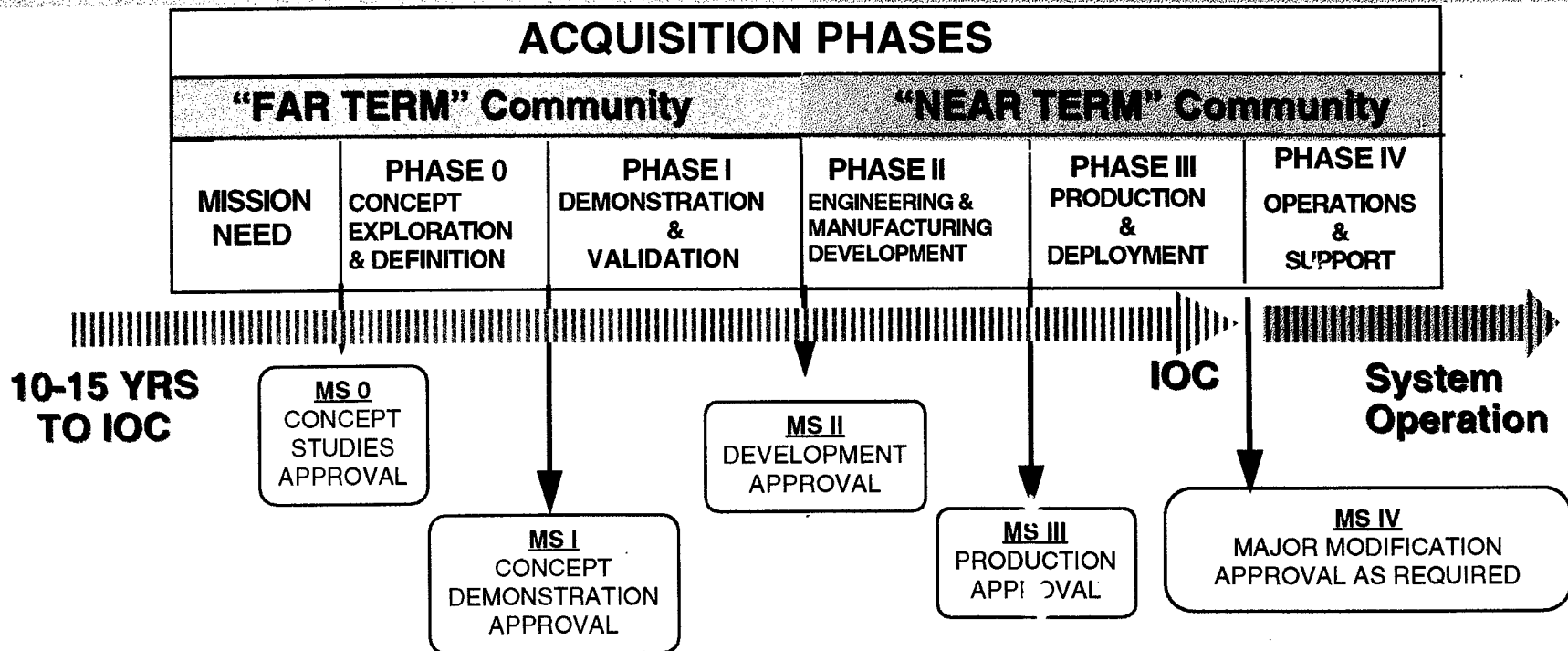
- **Integrated Process**

- Analysis supporting all phases of system development

# ISA REQUIREMENTS BY COMMUNITY

DECREASING  
UNCERTAINTY  
IN DESIGN

INCREASING  
CONFIDENCE  
IN CAPABILITY



# REQUIREMENTS FOR ISA

- **Consensus within “Near Term” and “Far Term” communities**
  - > **NEAR TERM USERS**
    - » For OT programs: high fidelity missile flyout, vulnerability and endgame models
  - > **FAR TERM USERS**
    - » For Requirements and DT(and DOT&E): mission level assessments of military worth
- **However, less agreement between communities**
  - » OT focused on engagements with current threat systems
  - » DT focused on mission & campaign level, emerging threats
  - » Campaign Planners, CINCs not represented

# **ASSESSMENT OF CURRENT M&S INITIATIVES**

**(Are current initiatives such as HLA, J-MASS, DIME, etc. supporting Integrated Assessments?)**

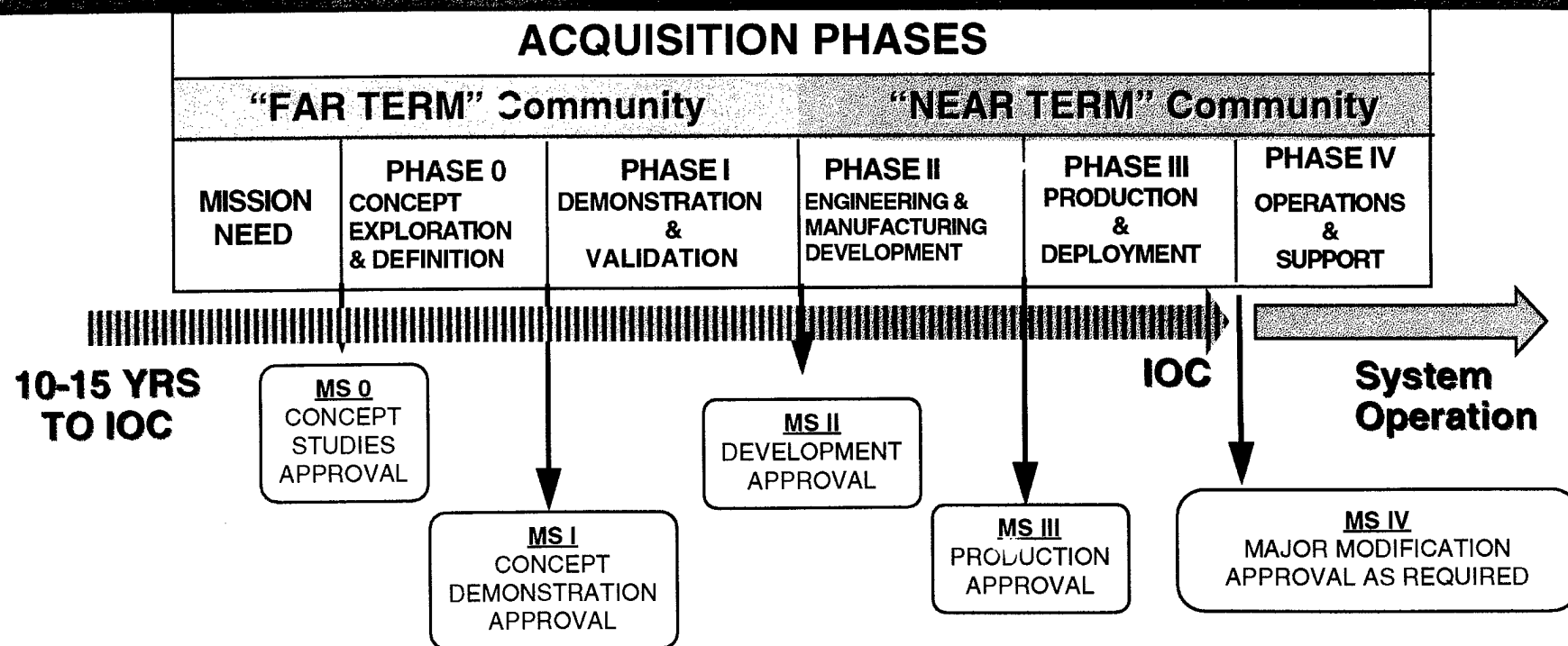
- **Several participants expressed concern that funding for architecture development (JMASS/HLA) is taking precedence over fixing model credibility problems**
- **J-MASS not seen as supporting immediate needs of “Far Term” Community**
  - **Current focus is on high fidelity models to support Near Term issues (e.g., B-1 DSUP)**
- **JTCG/AS seen as needing to take a leadership role in introducing survivability requirements into these overarching initiatives**
  - **Requires participation from all concerned: Customers, modelers, analysts, operators, testers ...**

## **SHORTFALLS (NEAR TERM USERS)**

- **Across-the-board concern with credibility of models and analysis at the engagement level (current threat systems)**
  - ECM effects models
  - Blue system models
  - Threat models
  - Threat Missile Endgame models (Pk)



# The Acquisition Cycle from the Threat Perspective



# **SHORTFALLS (FAR TERM USERS)**

- **Requirement for “Iterative Analysis Process”**
  - Due to uncertainties in future scenarios, threats, system capabilities
    - » Need a process for adding new threat technology or technology effects into models
    - » “Authoritative threat databases” are inadequate for long term design leads
  - Requirement for parametric sensitivity analysis
    - » Must evaluate design sensitivity to assumptions about unknowns
    - » “ECM Robustness Analysis” is one example
- **Difficulty conducting credible risk and cost trade-off studies**
  - Need “U.S. System vs. Threat System” at the mission level
    - » Required for cost benefit analysis (CAIV)
    - » IADS and C4ISR modeling particularly important

# GENERAL ISSUES

- **Argument over focus: M&S Technology vice Analysis Requirements**
  - Credibility of engagement level simulations seen as taking a back seat to HLA compliance
  - Participants concerned that resources needed to improve analysis capability are focused on other M&S initiatives
  - Cost implications of re-writing existing M&S tools in JMASS architecture an issue
- **Concern that M&S results are seen as “the answer”**
  - M&S are one tool out of many that provide information to analysts
  - Analysts cannot be viewed as “data entry clerks” once authoritative databases and models developed

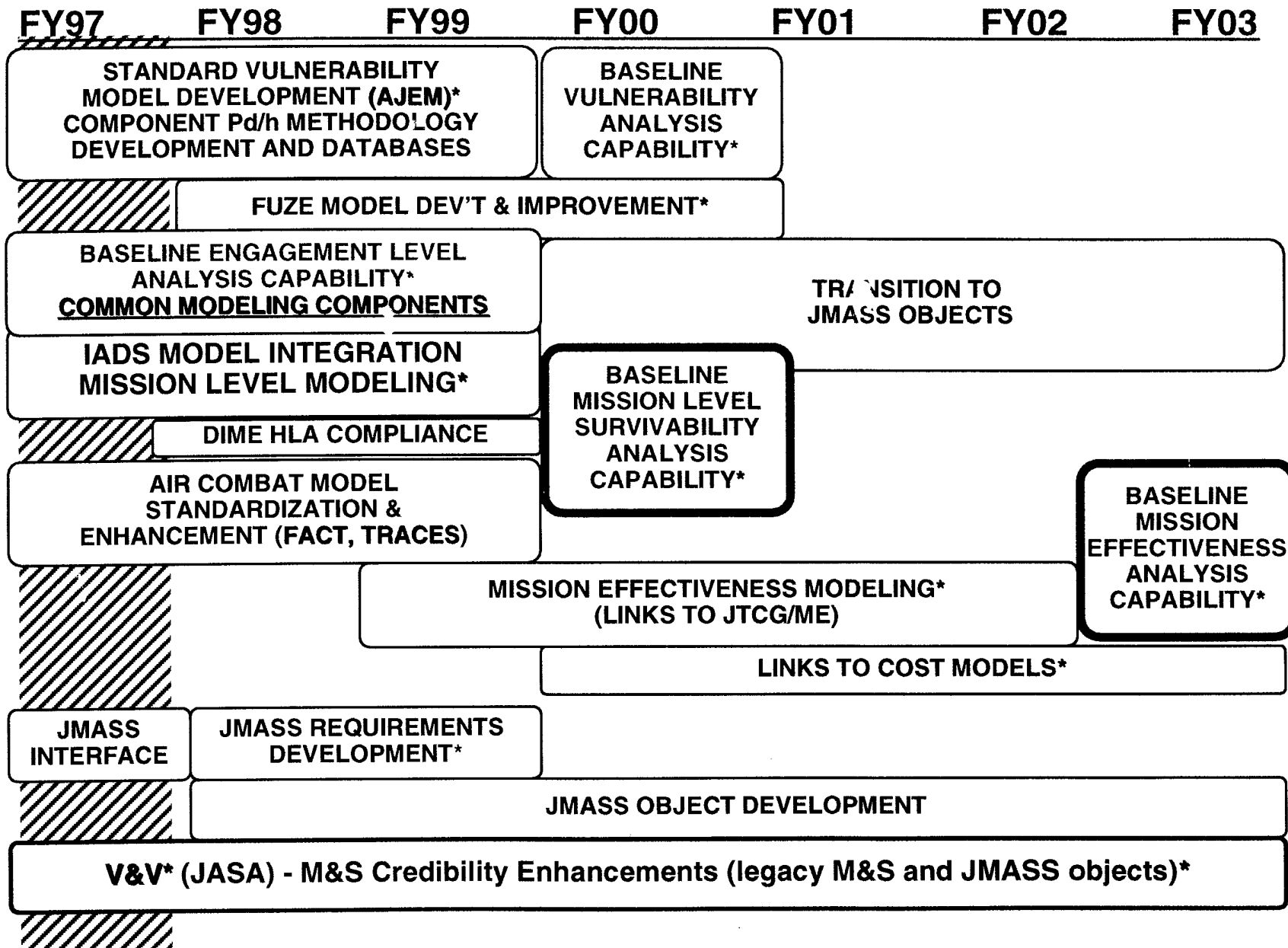
# **WORKSHOP IMPLICATIONS FOR JTCG/AS**

- **MORE EMPHASIS ON M&S CREDIBILITY**
  - Particular y at the engagement level
  - Requirements for missile endgame improvements
- **NEED FOR MISSION LEVEL ANALYSIS CAPABILITY**
  - More emphasis on modeling of IADS
  - **LINKAGES TO COST MODELING**
- **REQUIREMENTS FOR MISSION EFFECTIVENESS MODELING**
  - Survivability as an element of military worth
  - Closer ties with JTCG/ME
  - FY98 Workshop
- **JTCG/AS SHOULD TAKE ON A “LEADERSHIP ROLE” IN DEFINING JMASS REQUIREMENTS**
  - Implications for long term SURVIAC role as well

# **“PK DAY”**

- **Held in conjunction with the Integrated Survivability Assessment Workshop**
- **Objectives:**
  - **Initiate joint service approach to Pk analysis methodology in support of EW assesment**
    - **Net Reduction in Lethality (NRL) vs Reduction In Lethality (RIL)**
- **Issues Identified:**
  - **Near Field Signature Prediction**
    - **For fuzing, terminal guidance (miss distance)**
  - **Continuous Rod Warheads**
  - **Standardized PK Codes**
- **Provides direction for AJEM development**

# JTCG/AS METHODOLOGY ROADMAP



\* Identified at ISA workshop

# **SUMMARY**

- **INTEGRATED SURVIVABILITY ASSESSMENT IS CRITICAL**
  - To cost-effective aircraft system design, T&E
- **JTCG/AS WORKSHOP IDENTIFIED USER REQUIREMENTS**
  - Future workshops will work on implementation details
- **JTCG/AS ROADMAP WILL ESTABLISH STANDARD, ACCEPTED, JOINT SERVICE TOOLS AND PROCESS**
  - Leveraging service efforts
- **WE NEED PARTICIPATION FROM OSD, THE SERVICES AND INDUSTRY TO MAKE IT WORK**
  - Workshop participation, funding participation

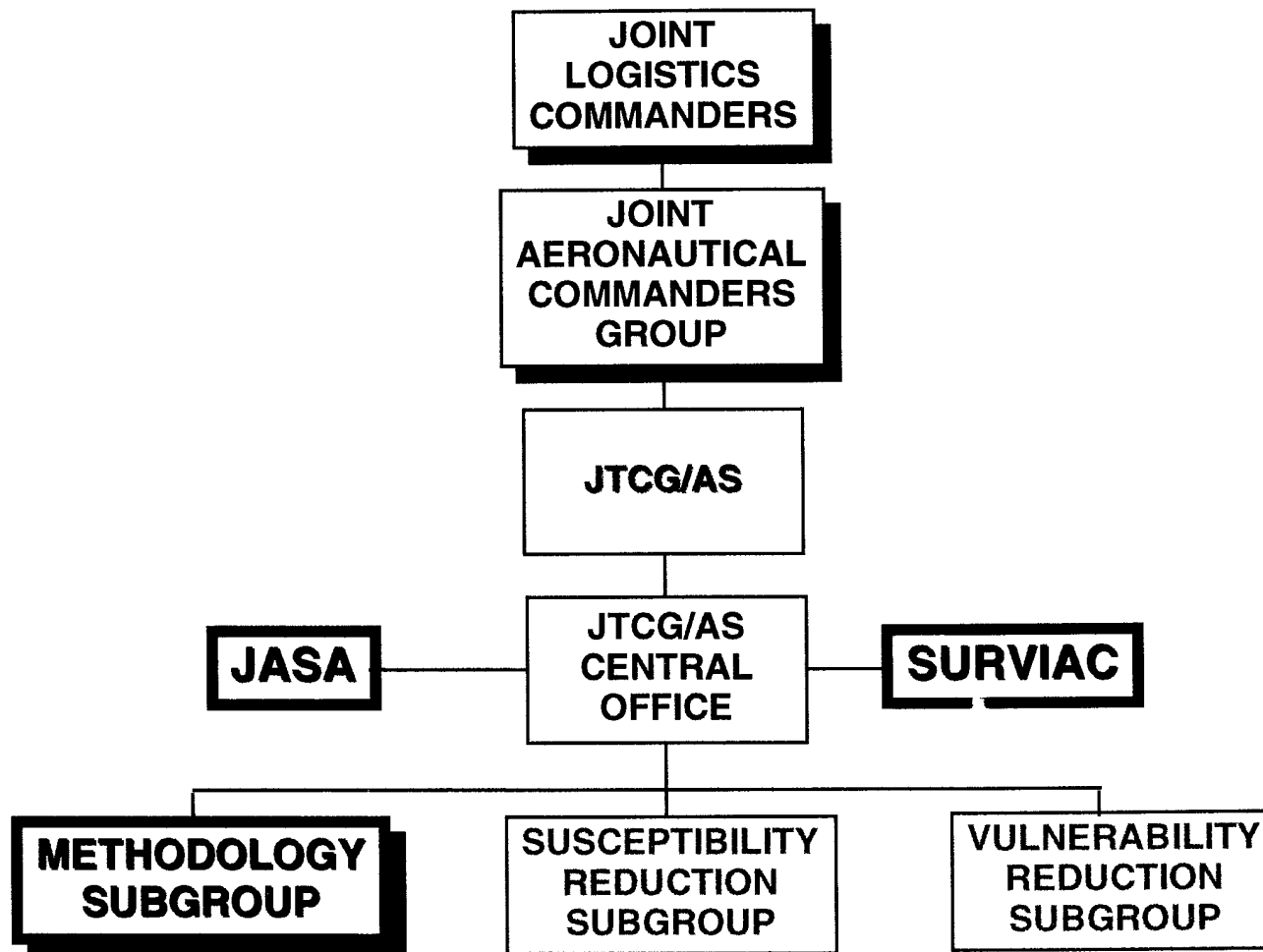
## **Backup slides**



# WHAT IS THE JTCG/AS?

- **Joint Technical Coordinating Group on Aircraft Survivability**
- **Chartered by the Joint Aeronautical Commanders Group (JACG) to increase the survivability of aeronautical systems in a nonnuclear threat environment**
  - Coordinate inter-service exchange of information
  - Implement efforts to complement Service survivability programs
  - Ensure availability of aircraft survivability R&D, analytical methodologies and systems criteria
- **JTCG/AS Methodology Subgroup Vision:**
  - Establish an accepted Joint Service Methodology for conducting air weapon system survivability analysis using a flexible and efficient computational environment based on a set of credible modeling components

# ORGANIZATIONAL RELATIONSHIPS



# **JTCG/AS M&S REQUIREMENTS**

- **TRI-SERVICE ACCEPTED M&S FOR SURVIVABILITY ANALYSIS**
  - Accepted by the community
  - Configuration Managed
  - Meeting a V&V standard
- **COORDINATED DEVELOPMENT**
  - Leveraging service M&S initiatives for multi-service use
- **AVAILABLE TO THE TRI-SERVICE ACQUISITION COMMUNITY**
  - Documented
  - Distributed through SURVIAC

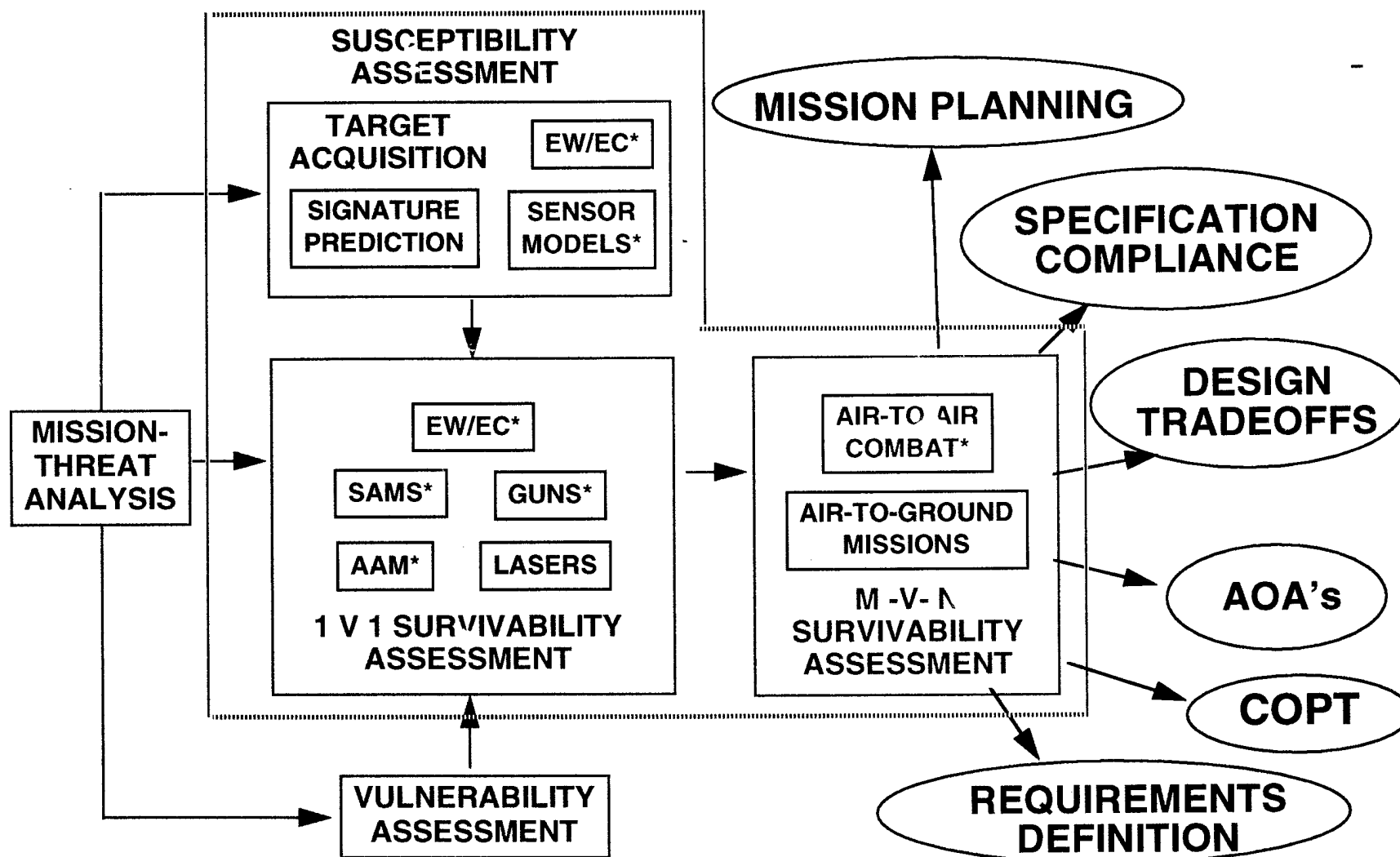
## **WHAT IS SURVIAC?**

- **Survivability/Vulnerability Information Analysis Center**
  - Chartered under the JTCG/AS and JTCG/ME
  - Funded by DLA
- **Provides data, standard methodologies and analysis in support of system survivability and lethality**
  - Combat survivability data base
  - Workshops, training
  - Model and simulation repository & distribution
- **Model entry into SURVIAC constitutes tri-service endorsement**
  - JTCG/AS and/or JTCG/ME

## **WHAT IS JASA?**

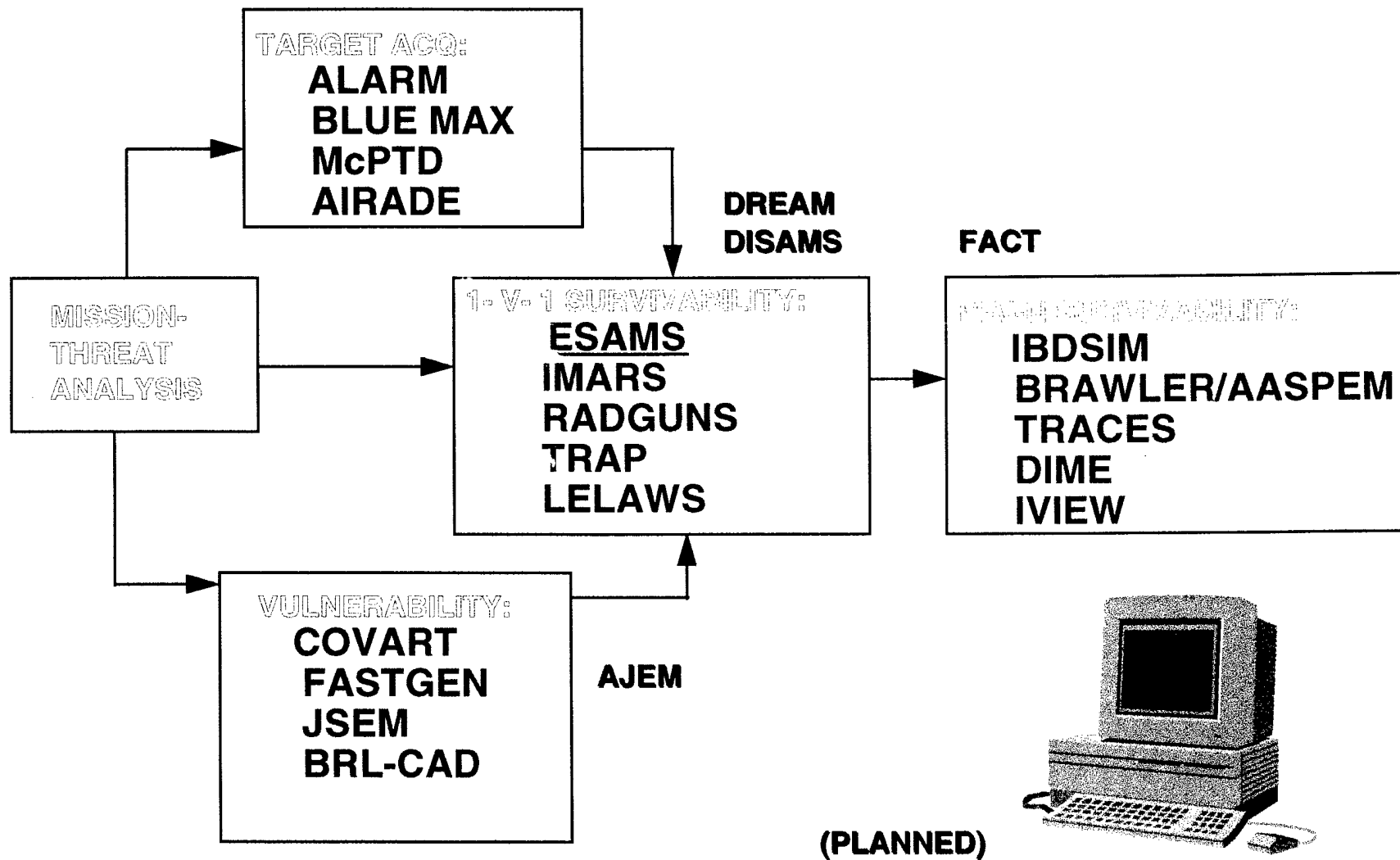
- **JOINT ACCREDITATION SUPPORT ACTIVITY**
- **Provides Model and Simulation (M&S)  
Verification, Validation and Accreditation (VV&A)  
Support**
  - To acquisition programs (and anyone else who needs help)
  - JTCG/AS Central Office serves as central Washington, D.C. POC and provides coordination with customers
  - Technical services provided through program office at NAWCWPNS
- **A response to stated customer requirements for continued VV&A support from a joint activity**
  - Builds on customer base from the SMART project

# THE SURVIVABILITY ASSESSMENT PROCESS



\* ADDRESSED BY SMART

# CURRENT JTCG/AS MODELS IN THE ASSESSMENT PROCESS (IN SURVIAC)



# RELATIONSHIP TO MISSION EFFECTIVENESS

